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Enclosed for filing is a patent application entitled
SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES
by GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, and KEVIN C. KLINGLER

X This is a continuation-in-part of application Serial No. 08/532,527 filed 9/22/95.
X Enclosed is an Assignment for recordation.
X Enclosed is a verified statement to establish small entity status.
X Enclosed are 12 sheets of drawings.
X Enclosed is a duplicate copy of this sheet.

The filing fee has been calculated as shown below:

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2. Total Claims:	19 - 20 =	0	x11 =	0	x 22 =	
3. Independent Claims:	4 - 3 =	1	x41 =	41	x 82 =	
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Arthur Freilich

TITLE: SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES

INVENTORS: GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, KEVIN C. KLINGLER

This application is a continuation in part of application Ser. No. 08/532,527, filed September 22, 1995, now allowed.

BACKGROUND OF THE INVENTION

The present invention relates generally to hardware/software systems for generating audio and/or video sequences of prescribed duration and more particularly to such systems suitable for generating and correlating such sequences for producing multimedia presentations.

Exemplary multimedia presentations are formed from video source material, e.g., a video segment such as a film clip, and audio source material, e.g., an audio segment such as a sound track. Typically, the video source segment must be edited many times before an aesthetically satisfactory and proper duration video output sequence is achieved. The audio source segment must similarly be edited to form an audio output sequence that matches the duration of the edited video output sequence.

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SUMMARY OF THE INVENTION

The present invention is directed toward a system for compiling a sequence of data blocks for producing an audio and/or video output sequence having a duration corresponding to user-prescribed criteria.

In a preferred embodiment, a user (via a keyboard and/or mouse and a display monitor) chooses an audio and/or video source segment from a data storage library storing data representing original sound tracks, MIDI data, film clips, animation clips, etc., and prescribes the desired duration of an audio and/or video output sequence. Each segment in the data storage library is divided into data blocks whose characteristics are identified in a stored characteristic data table. Exemplary characteristics include (1) duration, (2) suitability for being used as a beginning or ending of an output sequence, and (3) interblock compatibility. Using this stored characteristic table and user-prescribed criteria (e.g., a duration specified via the keyboard), a block sequence compiler (preferably a software program executed by a computer) generates a plurality of audio and/or video block sequences satisfying these criteria which can be reviewed (e.g., played via an audio and/or video output device or displayed on a monitor) and/or saved for future use.

In an exemplary use, the block sequence compiler compiles a first output sequence suitable for presentation on a first channel. Optionally, the block sequence compiler can also compile one or more additional output sequences compatible with the first output sequence (according to additional stored

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characteristic table parameters) suitable for presentation on additional output channels to create a multimedia presentation.

In a further aspect of a preferred embodiment, the block sequence compiler is responsive a user-prescribed mood parameter stored in the characteristic table.

In a still further aspect of a preferred embodiment, the stored characteristic table additionally contains a parameter that identifies blocks that are fadeable. When a fadeable block is selected as an end block, the block sequence compiler can truncate the fadeable end block to generate an output sequence of the prescribed length which might otherwise not be achievable.

In a further aspect of a preferred embodiment, the block sequence compiler is responsive to a user-prescribed intensity parameter stored in the stored characteristic table.

In a still further aspect of a preferred embodiment, each block is identified in the stored characteristic table as having a hit point that defines the location (when present) of an intensity burst. The block sequence compiler can use the hit point parameter to place an intensity burst at a user-prescribed location in the compiled output sequence.

In another aspect of a preferred embodiment, the system enables a user to generate a sequence (or subsequence) of data blocks which can be executed one or more times, e.g., looping, to form an output sequence of extended duration. In a first variation, the compiler selects the last block of a sequence which is compatible with the first block to generate a repeatable sequence. Accordingly, the repeatable sequence can be repetitively executed from the first to the last block and then

looped back to the first block. In a second variation, blocks in the repeatable sequence are selected which have a reversible attribute, i.e., blocks that can be played either in a forward or a reverse direction. Accordingly, the repeatable sequence can be repetitively played in a forward direction from the first to the last block and then in a reverse direction from the last block to the first block, again resulting in a sequence having an extended duration.

Other features and advantages of the present invention should become apparent from the following description of the presently-preferred embodiments, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the present invention.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 comprises a functional block diagram of a block sequence compiler in accordance with the present invention for generating audio and/or video sequences having user-prescribed durations;

FIG. 2 is a simplified diagram of a characteristic table showing the parameters associated with each audio and/or video block;

FIG. 3A is a simplified flow chart of the operation of the system of FIG. 1;

FIG. 3B is a simplified flow chart depicting the process implemented by the block sequence compiler;

FIG. 4 is an exemplary characteristic table for a fifty second source audio and/or video segment;

FIG. 5 shows the iterations performed by the block sequence compiler according to the flow chart of FIG. 3B on the characteristic table data of FIG. 4;

FIG. 6 is a simplified flow chart depicting the process implemented by the block sequence compiler to compile a repeatable audio and/or video sequence generated by looping the last block to the first block of the compiled sequence;

FIG. 7 shows the iterations performed by the block sequence compiler according to the flow chart of FIG. 6 on the characteristic table data of FIG. 8;

FIG. 8 is an exemplary characteristic table for a fifty second source audio and/or video segment used in conjunction with the flow chart of FIG. 6;

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FIG. 9 is a simplified flow chart depicting the process implemented by the block sequence compiler by selecting blocks having a reversible attribute to compile a repeatable audio and/or video sequence;

FIG. 10 is an exemplary characteristic table for a fifty second source audio and/or video segment used in conjunction with the flow chart of FIG. 9;

FIG. 11 is block diagram an exemplary system for generating multiple compatible audio and/or video channels, i.e., multimedia, according to user-prescribed criteria; and

FIG. 12 is a simplified diagram showing multiple audio and/or video channels generated by the exemplary system of FIG. 11.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference now to the drawings, and particularly to FIG. 1, there is shown a block diagram of a preferred embodiment of an audio and/or video sequence generator 10 of the present invention for compiling a sequence of data blocks suitable for producing an audio and/or video output sequence having a duration corresponding to user-prescribed criteria. In a preferred embodiment, the sequence generator 10 is comprised of a computer-executed software program, generally initially present on a floppy disk, and which preferably finally resides on the hard disk of a personal computer (PC) 12, e.g., a Macintosh or IBM compatible PC, controlled by a processor 13. As such the following discussion, relates to these preferred PC environments. However, different computer platforms or hardware-only implementations are also considered within the scope of the invention.

The sequence generator 10 is primarily comprised of (1) a data storage library 14 (preferably comprised of data blocks corresponding to or pointing to audio tracks, MIDI data, video clips, animation, or any other data representative of sound or visual information) and (2) a block sequence compiler 16. In operation, a user interface 17, e.g., a keyboard/mouse 18, enables a user to select a source segment 28 from the data storage library 14 and prescribe a duration. This information is communicated to the block sequence compiler 16 which, under control of a software program executed by the processor 13 in the PC 12, fetches blocks of audio and/or video source information (preferably digital data) from the data storage library 14 and,

according to compilation criteria described further below, compiles a list of potential audio and/or video sequences that are preferably temporarily stored within a potential block sequence list depository 19. In the case of audio (e.g., an audio track or MIDI data) output sequence, the user can select to play the audio sequence via a sound card/speaker 20, review a list of potential block sequences via a monitor 21, or store selected sequences for future use, e.g., on a hard disk 22. Alternatively, in the case of a video sequence (e.g., video clip or animation data), the user can select to play the video sequence (preferably via a video card 24 and monitor 21), review a list of potential block sequences via the monitor 21, or store selected sequences for future use, e.g., on the hard disk 22. In either case, the block sequence compiler 16 can preferably be directed to only compile a single audio and/or video output sequence and then wait until prompted by the user to generate a next audio and/or video output sequence.

The data storage library 14 preferably contains library entries 26 pertaining to a plurality of audio and/or video source segments. Each library entry 26 is comprised of (1) an audio and/or video source segment 28 and (2) a stored characteristic data table 30 which describes the partitioning of the audio and/or video source segment 28 into multiple data blocks and the characteristics of each block. Although, the source segment 28 is shown as being located within the data storage library 14, one of ordinary skill in the art will recognize that the source segment 28 can alternatively be physically located outside of the library, e.g., on a CD-ROM or

DVD, and referenced, e.g., by pointers, by the characteristic table 30. FIG. 2 shows an exemplary structure for the characteristic table 30. Each entry 26 in the characteristic table 30 contains a definition/pointer 32 which includes identifying information for the library entry, e.g., a title and the physical location of the audio and/or video source segment 28, e.g., a CD-ROM file. Each characteristic table entry 30 is further divided into a plurality of entries that define blocks, i.e., audio and/or video data blocks, and associated characteristics for the audio and/or video from the audio and/or video source segment 28.

In a simplified example, an audio and/or video source segment 28 is divided into five blocks: A, B, C, D, E, F where the sequence ABCDEF corresponds to the audio and/or video source segment 28. Although, other combinations of blocks, e.g., FEDCBA, can also create audio and/or video sequences, not all block sequences will create aesthetically reasonable audio and/or video sequences. Thus, information is preferably derived to determine interblock compatibility, i.e., the ability of a block to sequentially follow (or alternatively sequentially precede) each other block according to aesthetic, e.g., musical, criteria. For example, while block C may reasonably follow block B, it may not be aesthetically reasonable for it to follow block A. Additionally, while some blocks, e.g., A, are suitable according to aesthetic criteria to reasonably start an audio and/or video sequence, other blocks are not. Similarly, only certain blocks, e.g., F, are suitable according to aesthetic criteria to reasonably end an audio and/or video sequence. Lastly, not all

audio and/or video source segments 28 can reasonably be divided into fixed length blocks. In fact, using reasonable aesthetic criteria, blocks will generally be differently sized. Consequently, audio and/or video sequences of many different durations can be achieved by combining different combinations of these differently-sized blocks. However, as previously described, the available combinations are limited by the compatibility between potentially adjacent blocks as well as their suitability to begin or end an audio and/or video sequence. Corresponding to these criteria, data in the characteristic table 30 contains parameters for each audio and/or video block pertaining to a (1) duration 34, (2) type attribute (e.g., beginning/ending) 36, and (3) an interblock compatibility list 38 (e.g., a list of which blocks can aesthetically follow and/or precede the current block). Additionally, information (not shown) identifying the physical location of each audio and/or video block in the audio and/or video source segment 28 is preferably retained in the characteristic table 30. While data in the characteristic table 30 can be manually generated, automated procedures are also possible.

FIG. 3B shows a simplified flow chart exemplary of the iterative process implemented by the block sequence compiler 16 after being provided the user-prescribed data (as shown in FIG. 3A). As previously described, after the user has determined a selection 40 from the data storage library 14 and a duration 42, the block sequence compiler 16 operates on the data in the characteristic table 30 according to the flow chart of FIG. 3B. Accordingly, a list of potential output sequences is compiled

that conform to the characteristic table 30 and these sequences are stored in the potential block sequence list 19. In order to conform to the characteristic table, each block in an output sequence must be compatible with each adjacent block according to its interblock compatibility characteristic 38, i.e., each block must be compatible with blocks which directly precede and follow in an output sequence. Additionally, it is preferable that each sequence begin with a block having a beginning characteristic 38 set and end with a block having an ending characteristic 36 set.

FIG. 4 shows an exemplary characteristic table for a fifty second audio and/or video source segment 28. In this example, the source segment is partitioned into ten blocks, each being five seconds long. (While fixed length blocks exist in this example, this is generally not the case). In this example, blocks A and C have been marked as potential beginnings and blocks E and J have been marked as potential endings. In the example shown in FIG. 5, the user has selected a duration 42 of thirty-five seconds for this source segment 28. Accordingly, FIG. 5 shows the iterations performed by the block sequence compiler 16 on the characteristic table 30 of FIG. 4 according to the flow chart of FIG. 3B. FIG. 5 shows that the original audio and/or video sequence has now been rearranged into three potential sequences (ABCDEFGJ, ABCDEFHE, CDEFGHIJ) that each (1) have the prescribed duration, (2) begin with a beginning block, and (3) end with an ending block.

In an exemplary audio environment, the generator 10 allows users to quickly and easily create movie or record quality music soundtracks for any application or document that can import

sound. The sequence generator 10 is able to accomplish this by processing an audio source segment, e.g., music, in response to user inputs. The user selects a musical style and sub-style from a list, then specifies the length (preferably in minutes, seconds and tenths of seconds). A musical source segment is selected from the library that meets the user's needs and a custom version of that music is created that is exactly (within user-prescribed criteria) the specified length. If the user doesn't like the selected music, the user can hear a different version of the same music or a different piece music - all of the versions presented will fit the user's specifications.

By using music and its corresponding characteristic table 30 and input from the user, the block sequence compiler 16 can customize the following aspects of the music:

- The length of the music can be customized in tenths of a second increments from seconds to hours.
- Different versions of the same piece of music (sometimes hundreds of thousands of options) can be generated.
- In an alternative embodiment, the block sequence compiler 16 can customize the intensity of the music. The user can define a desired intensity curve 44. This will allow the user to have the program make a piece of music that begins softly (perhaps while an announcer speaks) and builds to a climax (perhaps when the narration has ended). In this embodiment, an intensity parameter 46 is added to the characteristic table 30 for each block and the block sequence

compiler 16 selects blocks that most closely correspond to the prescribed intensity curve 44.

- In a next alternative embodiment, the user can specify a mood selection 48 to modify the mood of the music without changing any other characteristics. In this embodiment, a mood parameter 50 is added to characteristic table 30. Additionally, multiple renditions of the audio source segment 28 are prerecorded corresponding to different moods. The block sequence compiler 16 will then select renditions that correspond to the prescribed mood parameter 50.
- In another alternative embodiment, a user can specify a first duration of background music followed by a second duration of introductory music. The compiler 16 will be able to locate two different pieces of music and make a smooth, musical, transition between them.
- In an additional alternative embodiment, blocks can be identified with a fadeable parameter 52 in the characteristic table 30. When a block is fadeable, its duration can be truncated to become a satisfactory end block, even if its duration would normally be too long. The compiler 16 can then truncate the fadeable block to achieve the user-prescribed duration. Additionally, the intensity of the end of the fadeable block will fade at a prescribed rate to reduce the effects of the truncation.

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- In still another embodiment, each block can be identified in the characteristic table 30 as having a hit point parameter 54 that defines the location (when present) of an intensity burst. When prescribed by the user, the block sequence compiler 16 can use the hit point parameter 54 to place an intensity burst at a user-prescribed location (e.g., defined by intensity curve 44) in the generated audio output sequence.

Similar aspects of a corresponding video (e.g., video clip or animation) sequence can also be customized by the compiler 16 according to data within the characteristic table 30. For example, if a static parameter 55 is placed within the characteristic table 30, this parameter can be used to identify blocks, preferably additionally having an ending type 36, that can be extended to a desired duration and thus can be used to simplify matching the user-prescribed duration 42. Accordingly, especially in a video environment, the last block can end with a still picture (a "freeze frame") that can be maintained as long as required to produce a sequence having the prescribed duration 42.

The following defines the data structure for each block of the characteristic table in this exemplary audio embodiment:

fileInfo	a pointer to which audio source segment this block is associated with
blockStart	the sample number within the audio source segment at which this block begins

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blockLength	the number of samples that this block contains. The end sample number is derived by adding blockStart and blockLength
blockName	the name to display on this block (no longer than 15 characters
blockDesc	the long text description of this block (up to 63 characters)
compatibility	an array of bits specifying this block's compatibility with all other blocks in this file (described below)
usageFlags	bit flags indicating properties of this block (described below)
nextBlock	the block number of the best block to following this block
quickEnd	the block number of the best next block to end the music quickly
blockSection	a section number of this block assigned for use in grouping sub-blocks into grouped blocks for display
blockPriority	a priority number of this block assigned for use in displaying blocks at different detail levels
blockType	a set of bits specifying if this block should be displayed, if the block is in-use, and other status flags. USER_BLOCK_TYPE, INVISIBLE_BLOCK_TYPE, AVAILABLE_BLOCK_TYPE
selected	a True/False flag indicating if the block is currently selected
intensity	each block is assigned an intensity index in relation to the other blocks in the file. The higher the intensity number, the more intense the audio in the block is in relation to the other blocks.
hitPoint	the sample number, if any, of a musical "Hit" within the block. (0 for no significant hit)
moodIndex	a number grouping this blocks mood with other blocks mood. All blocks with the same moodIndex will have the same mood.

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next a pointer to the next block

Compatibility

Each block has an array of unsigned longs which are used as an array of bits. Each bit corresponds to a block from the data storage library 14, e.g., bit 15 should be set if the block is compatible with block 15. Compatible blocks are blocks which sound musically correct when they are played one after the other. For example, Block A should be flagged as compatible with Block B when it sounds musically correct to listen to Block A followed by Block B. If Block B was the 24th block from the library source segment, then bit 24 of Block A's compatibility array should be set.

USAGEFLAGS

DEAD_END_FLAG	Set if this block will lead you directly toward an ending. Set this bit if this block is a bad choice to build a long cue (1L<<0)
NEXT_CONTIGUOUS_FLAG	Set this bit if the next block doesn't need a crossfade to make a good sounding transition (1L<<1)
FADEABLE_BLOCK	Set this bit to signal that this block can be effectively faded (in volume) to any length. (1L<<2)
BEGINING_BLOCK	Set this bit if the block is a good choice (sounds musically correct) to begin a selection (1L<<30) // 0x40000000
ENDING_BLOCK	Set this bit if the block is a good choice to end a selection (1L<<31) // 0x80000000

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While some of the above functions (further defined in the data structure below) can be applied to existing music (through a process of specifying block characteristics), some are dependent on a custom music library in which music is composed and performed in a specific format.

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struct BlockStruct {
            SoundFileInfoPtr    fileInfo; //  pointer  to  file
                                          struct for this block
            unsigned long       blockStart;// sample number
            unsigned long       blockLength;// number of samples
            Str15               blockName;
            Str63               blockDesc;
            unsigned long       compatibility[COMPAT_SIZE];
            unsigned long       usageFlags;
            short               nextBlock;
            short               quickEnd;
            unsigned char       blockSection;
            unsigned char       blockPriority;
            BlockTypes          blockType;
            Boolean             selected;
            BlockStructPtr      next;
};
```

HINTING/WARNING

Using the characteristic table data associated with each data block, the user is assisted by visually displaying information about the blocks. Block attributes including beginnings, endings and compatibility are all displayed.

- Beginning- displayed by a stair-step pattern on the left edge of the block
- Ending- displayed by a stair-step pattern on the right edge of the block
- Compatibility- the rightmost end cap of a selection in the sequence window is colored and all of the compatible blocks in the block window will have their left end caps colored.
- Warning- when two non-compatible blocks are next to each other, we display a red edge at their junction.

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The process of specifying characteristics of music and sound is both musical and technical. This process is used to provide as much information as possible about each piece of music or sound so that the compiler 16 can make informed, musical decisions, when it manipulates the music according to requests from users. This process includes the following:

1. Block Start and End: The beginning and ending of each discrete music section (block) is determined. This necessarily determines the length of each block. Listen to the piece of music and divide it into segments based on musical phrases and musical uses called blocks. On average, there are fifteen blocks per minute of music.

2. Block Name: Code each block with a name and description.

3. Beginning Blocks: For each block a determination is made as to whether it would make a good way to start a musical section or phrase.

4. Ending Blocks: Same concept as that described for Beginning Blocks.

5. Block Compatibility: Each block is tested for its specific compatibility to each and every other block which comprise the source audio segment.

6. Intensity: Code each block's musical intensity relative to other blocks.

7. Fadeable Block: Each block has a determination made as to whether it sounds musically viable to fade or not.

In a further aspect of the present invention, a user may alternatively prescribe a repeatable audio and/or video sequence (or subsequence), e.g., a looping sequence, that is capable of repeating and thus has an extended duration. In this embodiment, a last block 56 of a compiled sequence 58 is chosen that is compatible (according to compatibility data 38) with a first block 60 of the compiled sequence 58. While the

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beginning/ending attribute 36 is of limited significance with such a repeatable sequence (and accordingly an ending attribute is preferably not required), it is still aesthetically preferable that the sequence initially begin with a block having a beginning attribute. Additionally, while a principal duration 62 of the compiled block sequence (the time duration from the beginning of the first block of the repeatable sequence to the end of the last block of the repeatable sequence) does not alter the duration of the looping sequence (i.e., repeating a twenty second portion thirty-five times or repeating a thirty-five second portion twenty times both result in the same extended durations), the aesthetic effect of such sequences are generally effected by the principal duration 62. Accordingly, it is preferable that the block sequence compiler 16 accept directions via user interface 17 to determine the sequence of blocks according to duration 42.

Accordingly, using the exemplary flow chart of FIG. 6, a user specifies duration 42 to specify the principal duration 62. FIG. 7 shows the processing of the data of FIG. 8 according to the flow chart of FIG. 6 for a principal duration of thirty-five seconds (compiling sequences ABCDEFGJ and ABCDEFHE). Accordingly, it is noted that while the end block of the principal loop may have an ending attribute 36 (e.g., block E), this is not a requirement of the algorithm of FIG. 6. Additionally, FIG. 7 shows the alternative processing when the algorithm of FIG. 6 is altered to eliminate the restriction (specified in program step 64) that requires that the compiled sequence begin with a block having a beginning attribute 36. Consequently, a sequence of CDEFGHIJ is compiled.

In a next variation, e.g., in a visual environment, portions of the source audio and/or video segment 28 are determined which can play equally well in a forward or in a reverse direction. Accordingly, an infinite loop can be defined by selecting a sequence of compatible blocks accordingly to compatibility list 38 that additionally have a reversible attribute 66 set. Accordingly, if block sequence compiler 16 operates on the data of FIG. 10 according to the algorithm of FIG. 9 and a prescribed duration 42 of twenty seconds, a sequence of CDEF, CDCD, or CDED will result. When played, these sequences will preferably reverse in direction at the end of the last block and at the beginning of the first block (when being played backwards).

While the above description has primarily discussed uses where the entire sequence is repeatable, alternative uses are also considered within the scope of the present invention. For example, the repeatable sequence could be only a portion, i.e., a subsequence, of the compiled output sequence. In an exemplary case, a first portion of the output sequence is compiled according to first user-specified duration (J), a second portion of the output sequence is compiled according to a second user prescribed principal duration (K) that is repeatable a user-specified number of times (L), and a third portion of the output sequence is compiled according to a third user-specified duration (M). Consequently, the resulting duration will be J+(K*L)+M.

As described, embodiments of the invention are suitable for generating audio and/or video output sequence suitable for presentation on a single output channel, e.g., as a

single audio track, a single MIDI output, a single video clip output, a single animation, etc. In an exemplary use, it may be required to compile a thirty second video sequence as a video output to combine with an existing audio track, e.g., assorted pictures of a new car with a predefined description of its features, or to add a musical interlude to a predefined video clip, and thus create a car commercial. However, it may also be desirable to compile both a video sequence and an audio sequence to satisfy the user-defined duration criteria 42, e.g., thirty seconds. However, it will generally be significant that the audio and video channels correlate, e.g., an audio track describing braking characteristics should not be combined with video clips of crash tests. Therefore, FIG. 11 shows a simplified block diagram of an embodiment that enables compiling (using multiple block sequence compilers 16a-16n or preferably by time sharing a single block sequence compiler 16) multiple channels of audio and video 68a-68n, i.e., multimedia, and cross-correlating the potential block sequence lists 19 using cross-correlator 70 to ensure compatibility between the multiple channels. To achieve this task, the cross-correlator 70 operates upon additional compatibility data 38, e.g., data which shows the interblock compatibility between the blocks in each channel 68, i.e., interchannel compatibility. For the example of FIG. 12, the characteristic table 30 contains additional compatibility data 38 to ensure that BLOCK 1_n is compatible with both BLOCK 1_1 and BLOCK 2_1 (since the blocks sizes are not the same on $CHANNEL_1$ and $CHANNEL_n$, BLOCK 1_n overlaps both BLOCK 1_1 and a portion of BLOCK 2_1).

Although the present invention has been described in detail with reference only to the presently-preferred embodiments, those of ordinary skill in the art will appreciate that various modifications can be made without departing from the invention. Accordingly, the invention is defined by the following claims.

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ABSTRACT OF THE DISCLOSURE

A block sequence compiler for compiling a sequence of audio and/or video blocks (e.g., audio tracks, MIDI, video clips, animation, etc.) suitable for producing one or more audio and/or video output sequences (i.e., audio, video, or multimedia) each having a duration corresponding to user-prescribed criteria. In a preferred embodiment, a user chooses an audio and/or video source segment from a predefined library and prescribes the duration of an audio and/or video sequence. Prior to depositing each audio and/or video segment in the library, the segment is partitioned into audio and/or video blocks that are identified in a corresponding characteristic data table with characteristics including (1) duration, (2) suitability for being used as a beginning or ending of an audio and/or video sequence, and (3) compatibility with each block. Using this characteristic table and the user-prescribed criteria, i.e., duration, the block sequence compiler generates a plurality of audio and/or video sequences satisfying the user-prescribed criteria which can be reviewed, e.g., played, and/or saved for future use.

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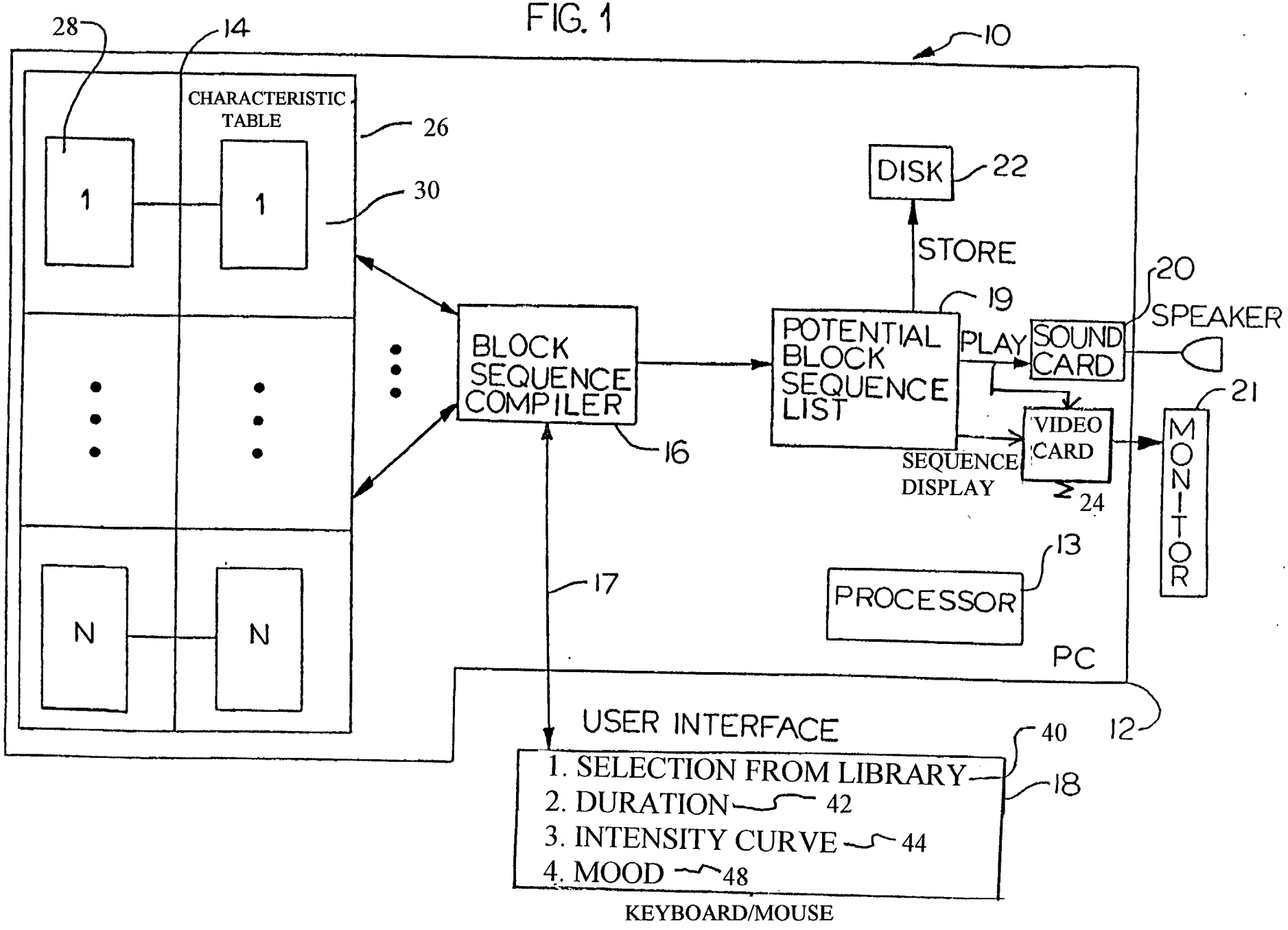
FIG. 1



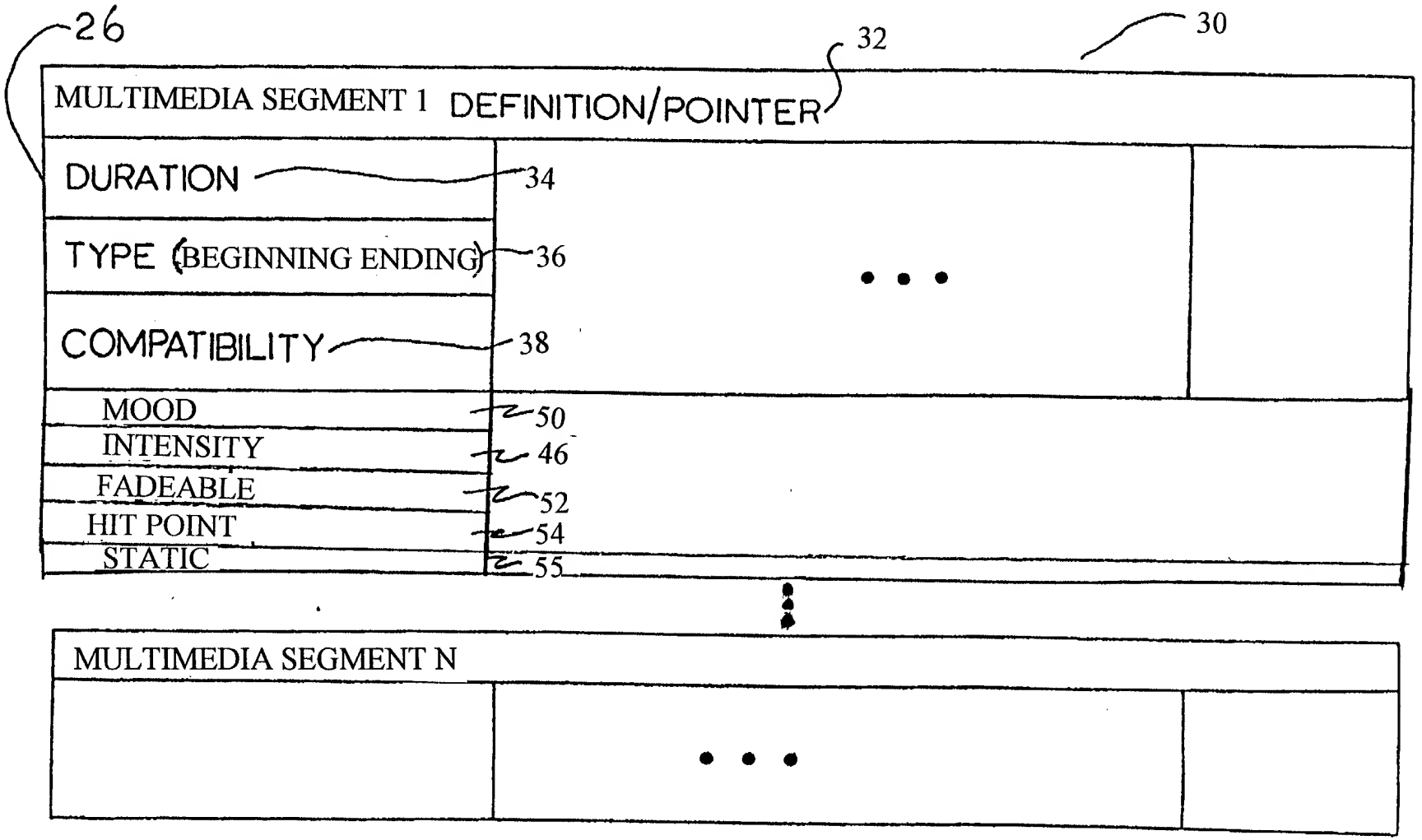

26
32
30
MULTIMEDIA SEGMENT 1 DEFINITION/POINTER
DURATION
34
TYPE (BEGINNING ENDING)
36
COMPATIBILITY
38
MOOD
50
INTENSITY
46
FADEABLE
52
HIT POINT
54
STATIC
55
MULTIMEDIA SEGMENT N

FIG. 2

Block Diagram

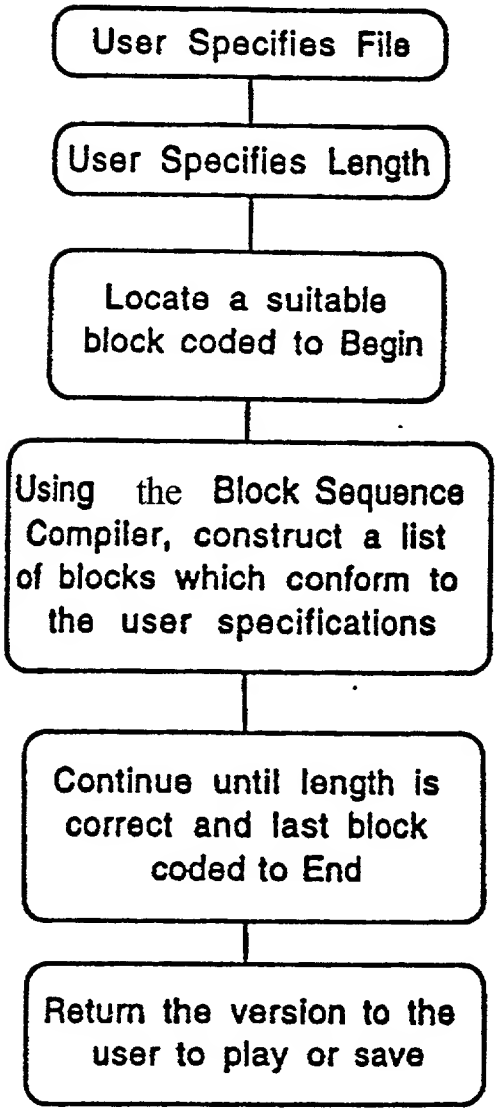


FIG. 3A

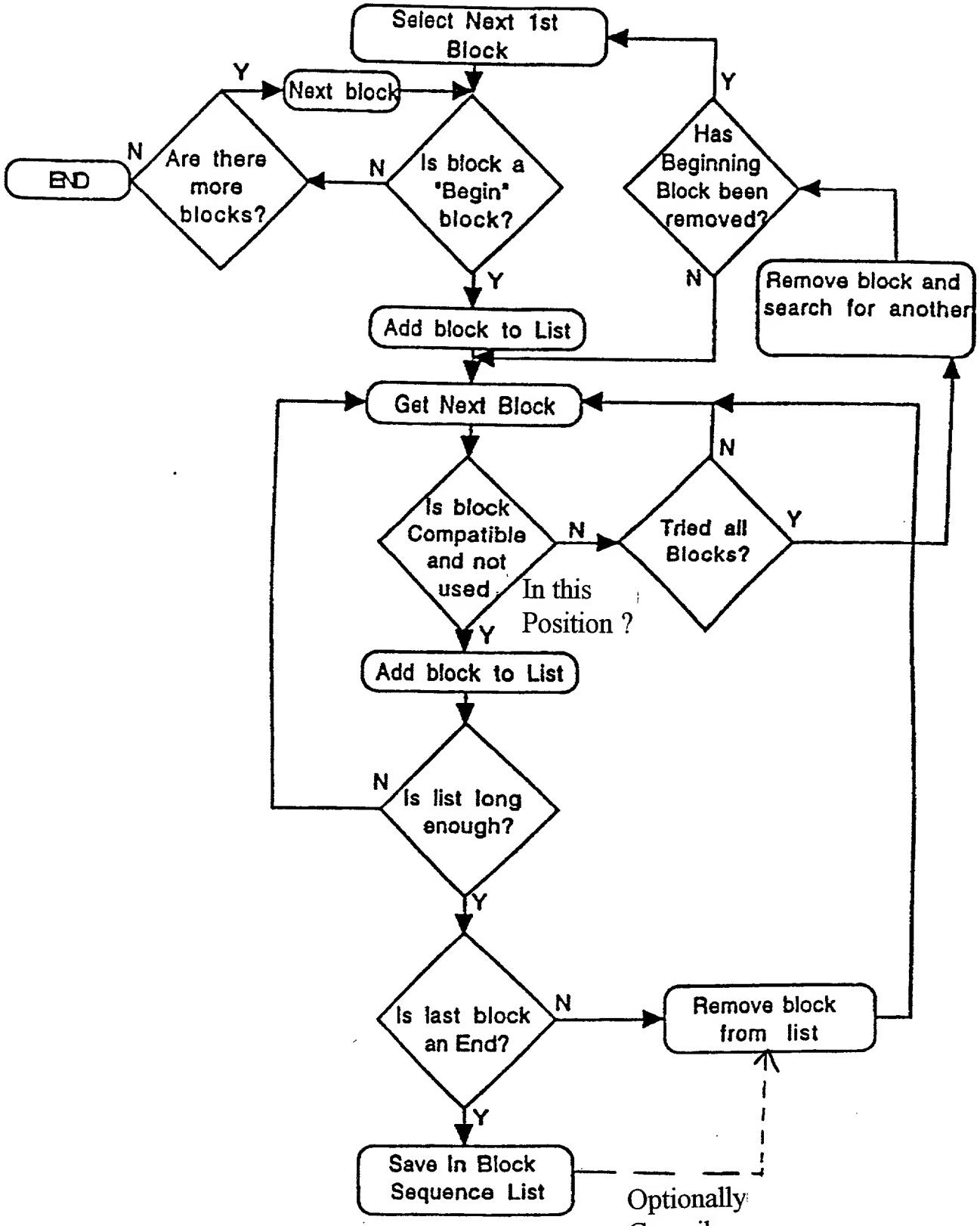

Select Next 1st Block
Next block
Y
N
END
Are there more blocks?
N
Is block a "Begin" block?
Y
Has Beginning Block been removed?
Y
N
Remove block and search for another
Add block to List
Get Next Block
N
Is block Compatible and not used
N
Tried all Blocks?
Y
In this Position ?
Y
Add block to List
N
Is list long enough?
Y
Is last block an End?
N
Remove block from list
Y
Save In Block Sequence List
Optionally Compile Next Sequence

FIG. 3B

30

	A	B	C	D	E	F	G	H	I	J
DURATION 34	5	5	5	5	5	5	5	5	5	5
BEGINNING/ ENDING 36	B		B		E					E
COMPATIBILITY LIST 38	B	C	D	E	F	G H	H J	E I	J	

FIG. 4

\	0	1	2	3	4	5	6	7	\		
	A									length = 5	A is the first block considered and it is a beginning so it is put in slot 1
	A	B								length = 10	B is considered next and it is checked for compatibility with A
											*
	A	B	C	D	E	F	G			length = 30	slots continue to be filled until...
	A	B	C	D	E	F	G	H		length = 35	the length is >= the desired length
	A	B	C	D	E	F	G	H		length = 35	H is checked as an ending, it is not so it is removed
	A	B	C	D	E	F	G			length = 30	I is tried and not compatible with G, so J is tried next
**	A	B	C	D	E	F	G	J		length = 35	*** J is compatible with G and it is an ending, so this sequence is returned **
											*
											A SEQUENCE IS RETURNED
											*
	A	B	C	D	E	F	G			length = 30	to continue looking for the next combination, J is removed
	A	B	C	D	E	F	G			length = 30	J is the last block so A is tried next...
	A	B	C	D	E	F	G			length = 30	blocks A - G are tried (H was the first one tried in this slot) and none are compatible
	A	B	C	D	E	F				length = 25	so G is removed from slot 6
	A	B	C	D	E	F	H			length = 30	H is compatible with F, so it is put in slot 6
	A	B	C	D	E	F	H	*		length = 30	I, J, A, B, C, D are all tried in slot 7 and either not compatible or not endings
**	A	B	C	D	E	F	H	E		length = 35	*** E is both compatible and an ending, so this sequence is returned **
											*
											PROCESS CONTINUES...
											*
	C									length = 5	basic SEEDING is performed by putting another beginning block in the first slot
**	C	D	E	F	G	H	I	J		length = 35	*** and building a sequence from there. **

FIG. 5

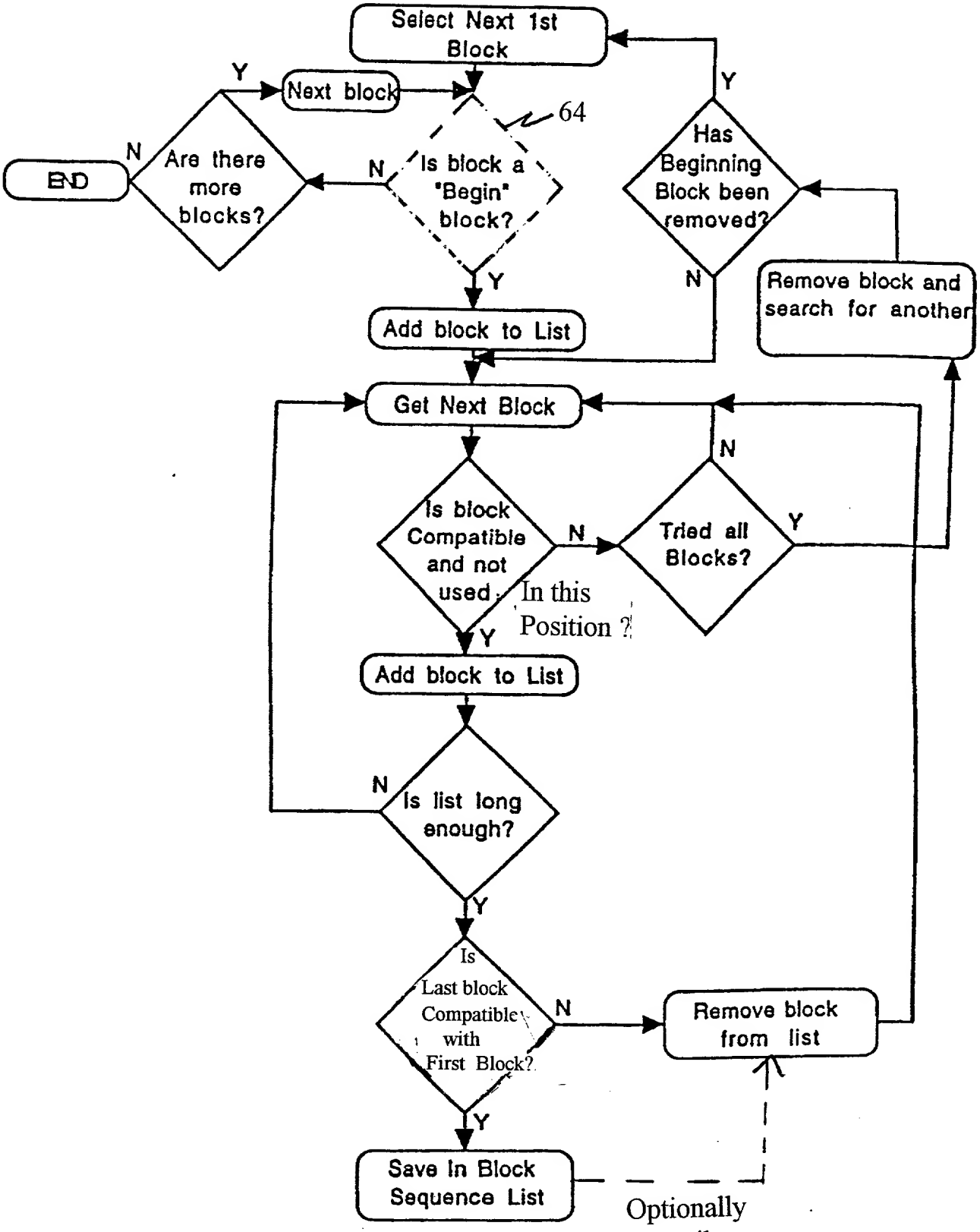

Select Next 1st Block
Y
Next block
64
N
END
Are there more blocks?
N
Is block a "Begin" block?
Y
Add block to List
Y
Has Beginning Block been removed?
N
Remove block and search for another
Get Next Block
N
Is block Compatible and not used
N
Tried all Blocks?
Y
In this Position ?
Y
Add block to List
N
Is list long enough?
Y
Is Last block Compatible with First Block?
N
Remove block from list
Y
Save In Block Sequence List
Optionally Compile Next Sequence

FIG. 6

	\ 0	1	2	3	4	5	6	7	\		
	A									length = 5	A is the first block considered and it is a beginning so it is put in slot 1
	A	B								length = 10	B is considered next and it is checked for compatibility with A
											*
	A	B	C	D	E	F	G			length = 30	slots continue to be filled until...
	A	B	C	D	E	F	G	H		length = 35	the length is >= the desired length
	A	B	C	D	E	F	G	H		length = 35	H is checked for compatibility with the first block (A), it is not so it is removed
58	A	B	C	D	E	F	G			length = 30	I is tried and not compatible with G, so J is tried next
**	A	B	C	D	E	F	G	J		length = 35	*** J is compatible with G and the first block (A), so this sequence is returned **
60									56		A SEQUENCE IS RETURNED
	A	B	C	D	E	F	G		62	length = 30	to continue looking for the next combination, J is removed
	A	B	C	D	E	F	G			length = 30	J is the last block so A is tried next...
	A	B	C	D	E	F	G			length = 30	blocks A - G are tried (H was the first one tried in this slot) and none are compatible
	A	B	C	D	E	F				length = 25	so G is removed from slot 6
	A	B	C	D	E	F	H			length = 30	H is compatible with F, so it is put in slot 6
	A	B	C	D	E	F	H	*		length = 30	I, J, A, B, C, D are all tried in slot 7 and either not compatible or not compatible with the first block (A)
**	A	B	C	D	E	F	H	E		length = 35	*** E is both compatible with H and the first block (A), so this sequence is returned **
											*
											OR ALTERNATIVELY WITH STEP 44 BYPASSED...
											*
	C									length = 5	basic SEEDING is performed by putting another beginning block in the first slot (Note C is not a beginning block)
**	C	D	E	F	G	H	I	J		length = 35	*** and building a sequence from there. ** Note J is compatible with I and C is compatible to follow J

FIG. 7

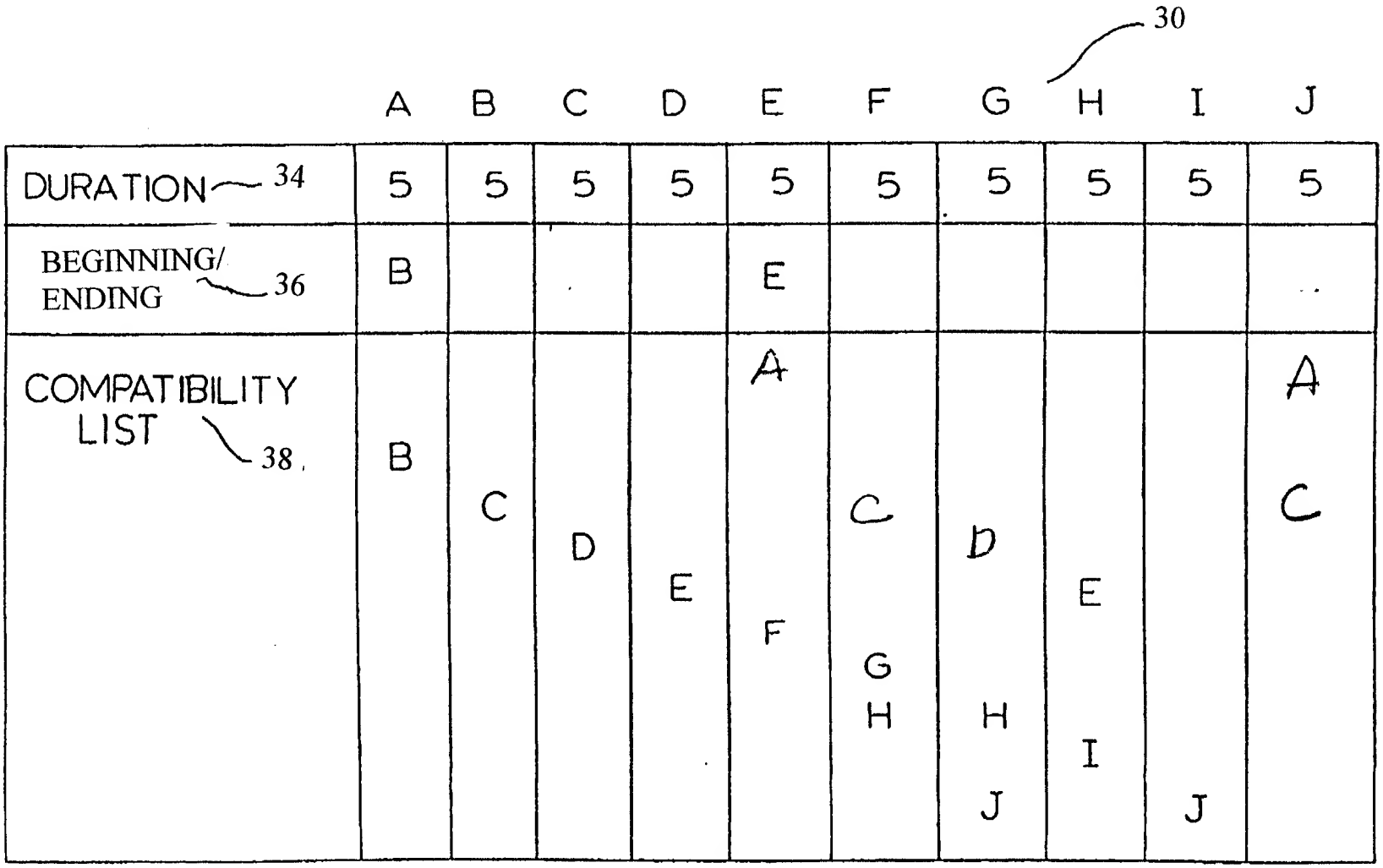

30
A
B
C
D
E
F
G
H
I
J
DURATION 34
BEGINNING/ ENDING 36
COMPATIBILITY LIST 38
5
B
A
C
D
E
F
C
G
H
D
H
J
E
I
A
C
J

FIG. 8

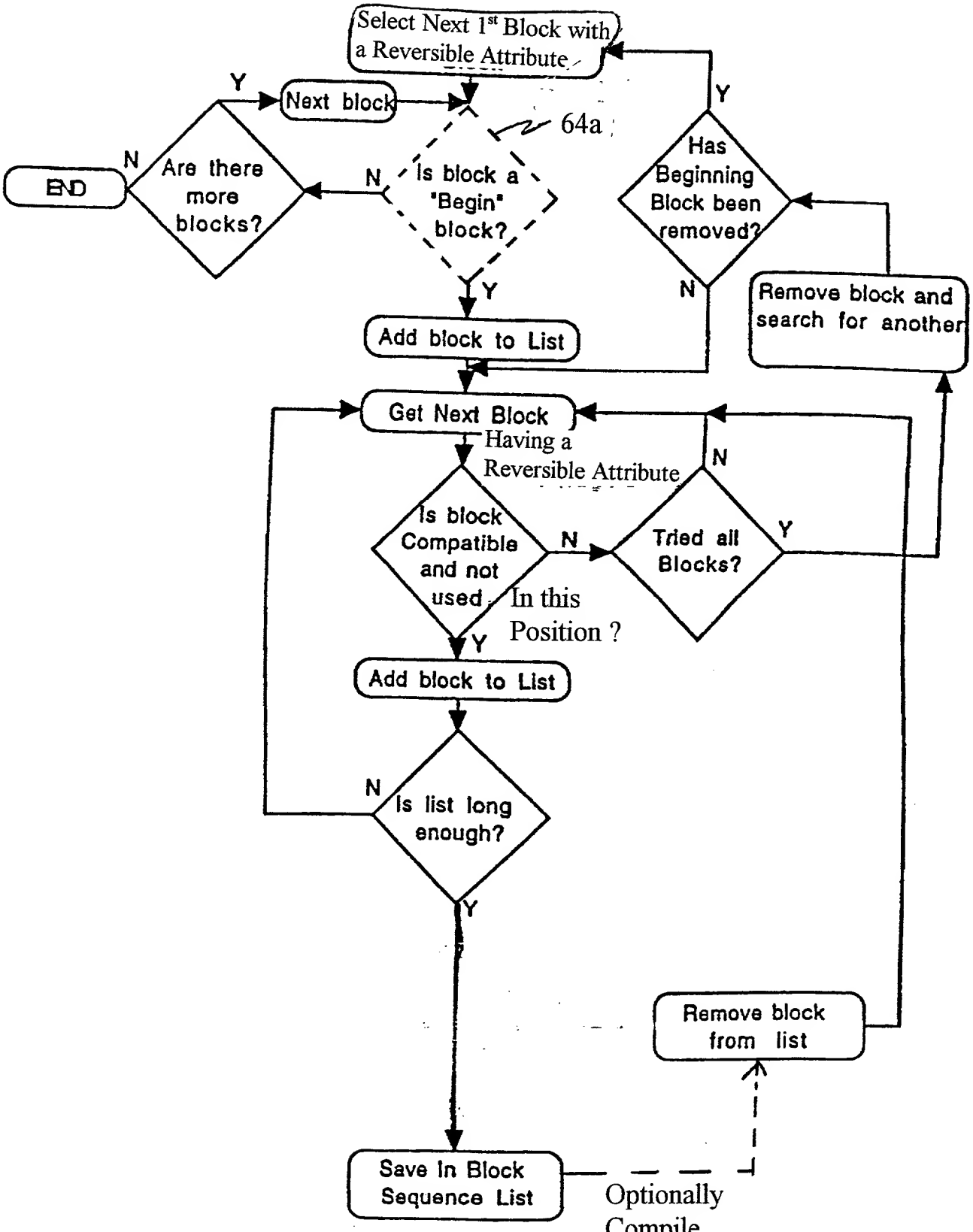

Select Next 1st Block with a Reversible Attribute
Y
Next block
64a
N
END
Are there more blocks?
N
Is block a "Begin" block?
Y
Add block to List
Y
Has Beginning Block been removed?
N
Remove block and search for another
Get Next Block
Having a Reversible Attribute
N
Is block Compatible and not used
N
Tried all Blocks?
Y
In this Position ?
Y
Add block to List
N
Is list long enough?
Y
Remove block from list
Save In Block Sequence List
Optionally Compile Next Sequence

FIG. 9

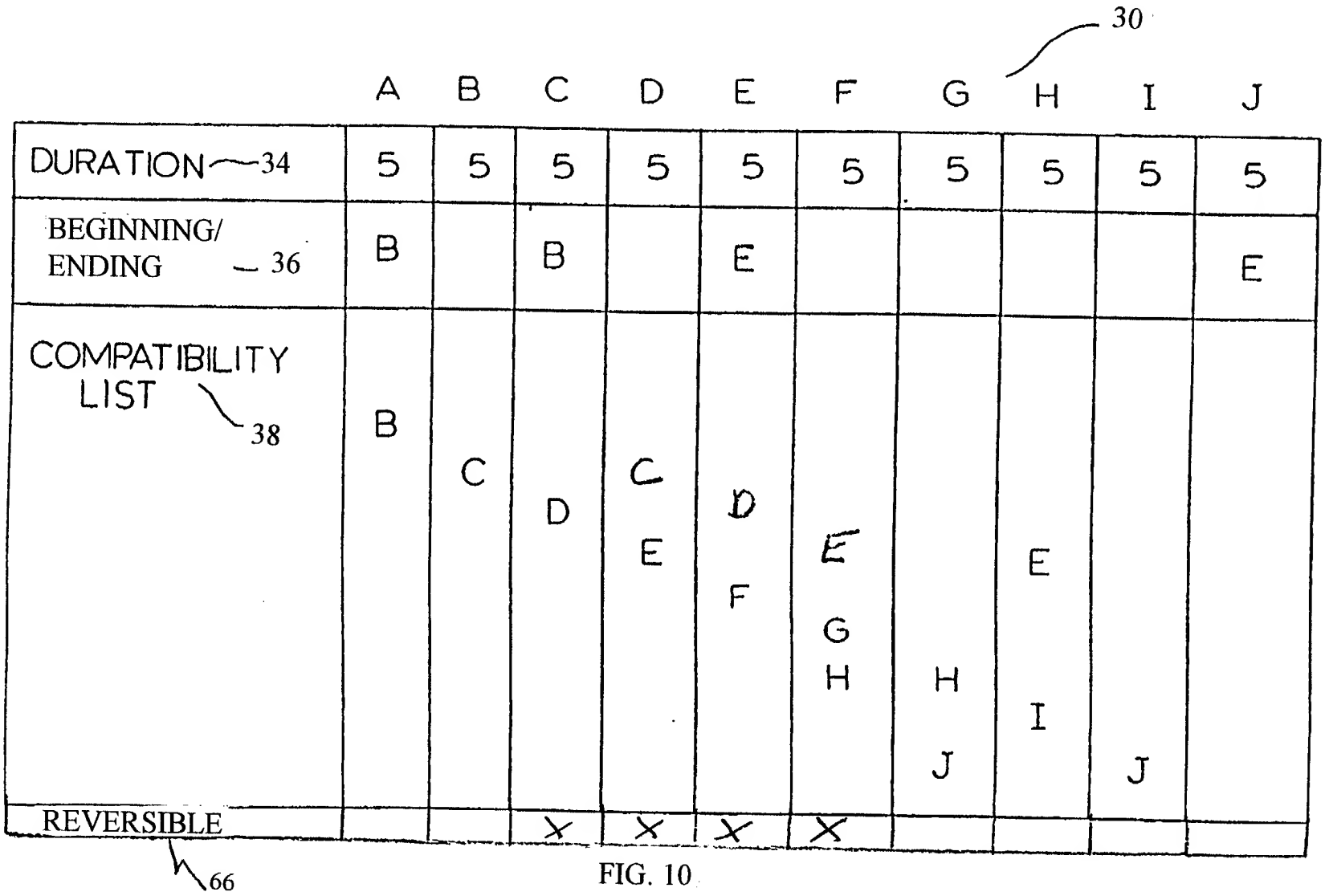

30
A B C D E F G H I J
DURATION 34
5 5 5 5 5 5 5 5 5 5
BEGINNING/ ENDING 36
B B E E
COMPATIBILITY LIST 38
B
C
D
C E
D F
E G H
H J
E I
J
REVERSIBLE 66
X X X X

FIG. 10

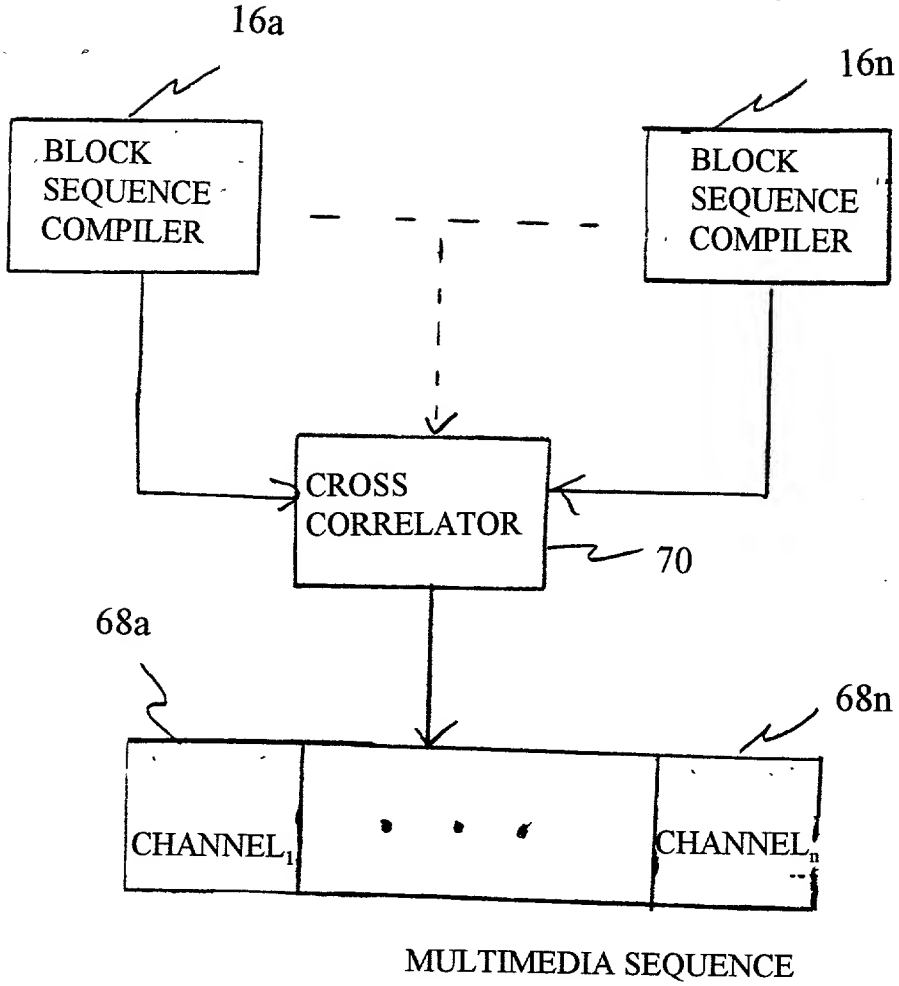

16a
16n
BLOCK SEQUENCE COMPILER
BLOCK SEQUENCE COMPILER
CROSS CORRELATOR
70
68a
68n
CHANNEL1
CHANNELn
MULTIMEDIA SEQUENCE

FIG. 11

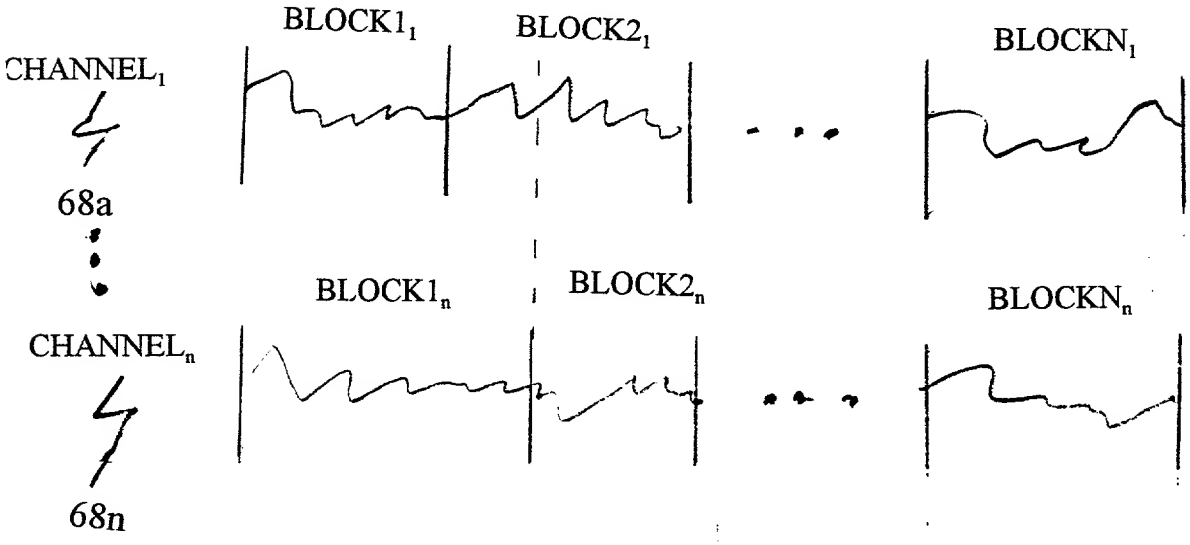

BLOCK1₁
BLOCK2₁
BLOCKN₁
CHANNEL₁
68a
BLOCK1n
BLOCK2n
BLOCKNn
CHANNELn
68n

FIG. 12

CLAIMS

We claim:

1. A system for compiling a sequence of blocks suitable for producing an audio and/or video output sequence having a prescribed duration, said system comprising:

a stored data table referencing one or more audio and/or video source segments wherein said table contains entries to partition each of said segments into multiple data blocks;

said table entries defining the characteristics of each block including its duration, its suitability to begin or end a sequence, and its interblock compatibility;

a user interface for enabling a user to prescribe a sequence duration; and

a block sequence compiler for iteratively compiling a list of one or more sequences each comprised of a plurality of blocks selected according to said user-prescribed sequence duration such that each said sequence conforms with said table entries.

2. The system of claim 1 additionally comprising means for displaying said list.

3. The system of claim 1 additionally comprising means to store at least one said sequence from said list.

4. The system of claim 1 additionally comprising means to play a selected sequence from said list.

5. The system of claim 1 wherein said table additionally comprises data corresponding to a mood parameter for each said block and said user interface additionally enables a user to prescribe a mood parameter and said block sequence compiler selects blocks according to said user-prescribed mood parameter.

6. The system of claim 1 wherein said table additionally comprises data corresponding to a fadeable parameter for each said block and said block sequence compiler selects an ending block having said fadeable parameter set and wherein such fadeable blocks can be truncated to achieve audio and/or video sequences of said user-prescribed sequence duration.

7. The system of claim 1 wherein said table additionally comprises data corresponding to an intensity parameter for each said block and said user interface additionally enables a user to prescribe an intensity curve and said block sequence compiler selects blocks according to said user-prescribed intensity curve.

8. The system of claim 1 wherein said table additionally comprises data corresponding to a hit point parameter for each said block for specifying when an intensity burst is present within said block and said user interface additionally prescribes an intensity burst location and said block sequence compiler compiles sequences of said blocks according to said user-prescribed intensity burst location.

9. The system of claim 1 wherein said user interface additionally enables a user to prescribe one of said audio and/or video source segments and said processor compiles sequences of blocks selected from said user-prescribed segment.

10. The system of claim 1 wherein said table additionally comprises data corresponding to a static parameter for each said block and said block sequence compiler can select a ending block having said static parameter set and wherein such static blocks can be extended to form sequences of said user-prescribed duration.

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11. A method for compiling a sequence of blocks suitable for producing an audio and/or video output sequence of a prescribed duration, said method comprising the steps of:

providing data corresponding to at least one audio and/or video source segment;

defining multiple data blocks corresponding to portions of said source segment and indicating characteristics corresponding to the duration of each block;

assigning characteristics to each block corresponding to the suitability of each block to begin or end a sequence and the interblock compatibility of each block;

defining a desired duration for an output sequence; and

iteratively compiling a list of one or more sequences each comprised of a plurality of blocks according to said desired duration such that each said sequence conforms with said characteristics of each block.

12. The method of claim 11 additionally comprising the step of selecting one of said source segments and wherein said iteratively compiling step compiles sequences of blocks from those blocks corresponding to said selected segment.

13. The method of claim 11 additionally comprising the step of displaying said compiled list.

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14. The method of claim 11 additionally comprising the steps of:

selecting one of said output sequences from said compiled list; and

outputting said selected sequence.

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15. A method for compiling a sequence of blocks suitable for producing an audio and/or video output sequence of a prescribed duration from an audio and/or video source segment having multiple data blocks corresponding to portions of said source segment and indicating characteristics of each block corresponding to its duration, its suitability of each block to begin or end a sequence, and its interblock compatibility, said method comprising the steps of:

defining a desired duration for an audio and/or video output sequence; and

iteratively compiling a list of one or more sequences each comprised of a plurality of blocks according to said desired duration such that each said sequence conforms with said characteristics of each block.

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DEPOSITION EXHIBIT

16. A system for compiling a sequence of blocks suitable for producing a repeatable audio and/or video output sequence having a prescribed duration, said system comprising:

a stored data table referencing one or more audio and/or video source segments wherein said table contains entries to partition each of said segments into multiple data blocks;

said table entries defining the characteristics of each block including its duration and its interblock compatibility;

a user interface for enabling a user to prescribe a sequence duration; and

a block sequence compiler for iteratively compiling a list of one or more repeatable sequences each comprised of a plurality of blocks selected to conform to said user-prescribed sequence duration and such that each said sequence conforms with said table entries.

17. The system of claim 16 additionally comprising means for displaying said list.

18. The system of claim 16 wherein each said repeatable sequence comprises at least a first block and a last block and wherein said last block of each said repeatable sequence is selected such that the first block of each said repeatable sequence is compatible, according to said table entries, to sequentially follow said last block of each said repeatable sequence.

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19. The system of claim 16 wherein said table entries additionally include a reversible parameter to identify blocks suitable for playing both in a forward or in a reverse direction and each said block selected by said block sequence compiler has said reversible parameter set.

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PATENT
DOCKET: 97/262 CIP

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES
the specification of which
_X_ is attached hereto.
____ was filed on_____as Application Serial No._____
____ and was amended on_____(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a),

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Number	Country	Date Filed	Yes	No

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Appln. Ser. No.	Filing Date	Status-patented,pending,abandoned
08/532,527	9/22/95	Pending

I hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Arthur Freilich	Reg. No. 19,281	Timothy T. Tyson	Reg. No. 28,915
Robert D. Hornbaker	Reg. No. 19,965	Lee Jay Mandell	Reg. No. 37,176
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10960 Wilshire Blvd., Suite 840
Los Angeles, California 90024-3704

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor GEOFFREY CALVIN HUFFORD
Inventor's Signature _____ Date 10/22/97
Residence 15792-2 MIDWOOD DRIVE, GRANADA HILLS, CA 91344 Citizenship U.S.
Post Office Address SAME AS ABOVE

Full name of second joint inventor CHRISTOPHER P. HUFFORD
Inventor's Signature _____ Date 10/21/97
Residence 10035 FULLBRIGHT AVE. CHATSWORTH, CA 91311 Citizenship U.S.
Post Office Address SAME AS ABOVE

Full name of third joint inventor KEVIN C. KLINGLER
Inventor's Signature _____ Date 10/21/97
Residence 9527 FULLBRIGHT AVE. CHATSWORTH, CA 91311 Citizenship U.S.
Post Office Address SAME AS ABOVE

PATENT
DOCKET: 97/262 CIP

Applicant or Patentee: GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, and KEVIN C. KLINGLER
Serial or Patent No.:_____ Filed or Issued:_____
For: SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c) - SMALL BUSINESS CONCERN

I hereby declare that I am
____ the owner of the small business concern identified below:
__X__ an official of the small business concern empowered to act on behalf of the concern identified below:
NAME OF CONCERN: SONIC DESKTOP SOFTWARE
ADDRESS OF CONCERN: P.O. Box 3205, CHATSWORTH, CA 91313-3205

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled SYSTEM FOR GENERATING PRESCRIBED DURATION AUDIO AND/OR VIDEO SEQUENCES
by inventor(s) GEOFFREY C. HUFFORD, CHRISTOPHER P. HUFFORD, and KEVIN C. KLINGLER
described in

__X__ the specification filed herewith
____ Application Serial No._____ filed on_____.
____ and was amended on_____(if applicable).
____ patent no._____, issued_____.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME_____
ADDRESS_____
Individual_____ Small Business Concern_____ Nonprofit Organization_____

NAME_____
ADDRESS_____
Individual_____ Small Business Concern_____ Nonprofit Organization_____

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING KEVIN C. KLINGLER
TITLE OF PERSON OTHER THAN OWNER PRESIDENT
ADDRESS OF PERSON SIGNING P.O. Box 3205, CHATSWORTH, CA 91313-3205

Kevin C. Klingler
Signature

10/21/97
Date